

# A new, possibly algal, microproblematicum from the Lower Carboniferous of England

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## Synopsis

*Hypocaustella cartimanduae* gen. et sp. nov. is described from the Lower Carboniferous (Viséan D<sub>1</sub>, D<sub>2</sub>) of northern England. It consists of small monostromatic growths of calcareous-walled hexagonal-prismatic cells, with occasional larger rounded-lenticular cells. The evidence for its possible interpretation as an early coralline alga, and the evolutionary implications of this, are discussed.

## Introduction

The little organism described below was discovered during examination for algae of two Viséan limestone samples. One is from the Great Scar Limestone of Ingleton, North Yorkshire; the other from the Oxford Limestone of Dunsall, Northumberland. The former is a biosparite with subordinate pyrites, rich in small foraminifera and microproblematica, with frequent ostracoda, occasional larger debris of brachiopods, bryozoa and serpulids, and rare fragments of the algae *Koninckopora* and *Ungdarella*. The other sample is also pyritic and foraminiferal.

## Systematic description

*Microproblematicum*, *incerta sedis*

Genus *HYPOCAUSTELLA* nov.

DIAGNOSIS. Small curved monostromatic growths of tiny hexagonal-prismatic calcified cells; growths presumed originally attached or partly encrusting, and sometimes showing branching; single larger rounded-lenticular cells occasionally present. Lower Carboniferous, Viséan D<sub>1</sub>, D<sub>2</sub>; northern England.

TYPE SPECIES. *H. cartimanduae* sp. nov.

GENERIC NAME. From a fancied resemblance of the cells to the hollow tiles of a Roman hypocaust or heating system.

*Hypocaustella cartimanduae* sp. nov.

Figs 1-7

DESCRIPTION. In numerous thin sections this organism appears as thin curved plate-like monostromatic growths, sometimes showing evidence of branching or division. All are under 1 mm in diameter, and a majority are 0.5 mm or less. None have been found attached to shell or other solid objects.

In vertical section the cells are square to high-rectangular. They vary in dimensions between one specimen and another, the smaller being square, the larger rectangular (Fig. 8). The basal calcification is usually well developed; the very thin lateral walls thicken at their outer terminations. An outer or upper calcification is only occasionally present, though the cells usually have a different crystalline infilling to that of the matrix. Some examples of apparent cell-roofing may

possibly be due to diagenesis at the infilling-matrix surface, but some are the horizontal continuation of the lateral cell-walls, as seen in vertical section. In transverse section the cells are uniformly rounded-hexagonal, giving a honeycomb appearance. Oblique sections through the walls show no trace of intercommunicatory pores.

Some specimens show single examples of larger cells occurring among the normal cells. They are rounded-lenticular in outline, and are about three times the diameter of the ordinary cells of the particular growth in which they occur. In height they are the same or up to one and a half times that of the ordinary cells (Fig. 8). All these special cells are clearly roofed, unlike many of the other cells.

**TRIVIAL NAME.** Commemorates Cartimandua, first-century Romano-British Queen of the Brigantes, from whose former territories the fossil comes.

**MATERIAL.** *Types.* British Museum (Natural History), Dept of Palaeontology, registered numbers V.21205d (Holotype: Fig. 7); V.21205b, V.21205c, V.21205d (Paratypes: Figs 2, 1, 3). From the Great Scar Limestone (Lower Carboniferous, Viséan D<sub>1</sub>) of Mealbank Quarry, Ingleton, North Yorkshire, England.

*Other material.* Numerous examples in eight further thin sections from the same sample, V.21205 (H. P. Lewis Coll., 1930). Also examples in four thin sections of the Oxford Limestone (Viséan D<sub>2</sub>) of Dunsall Old Quarry, Berwick on Tweed, Northumberland, V.54331 (E. J. Garwood Coll.).

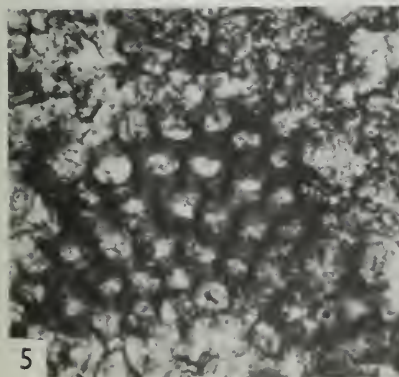
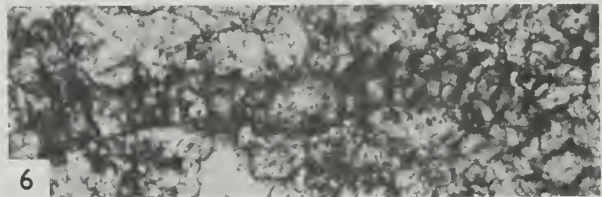
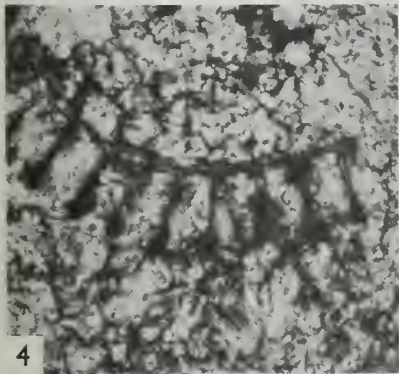
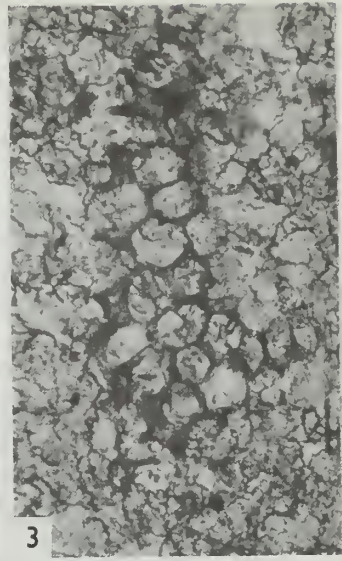
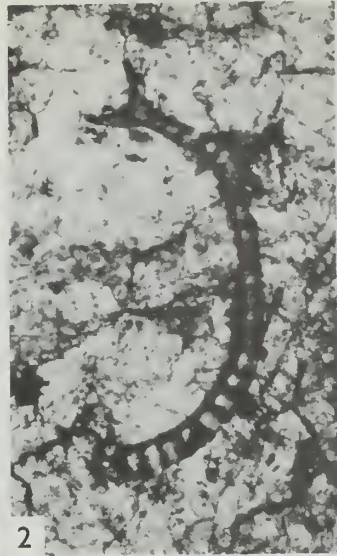
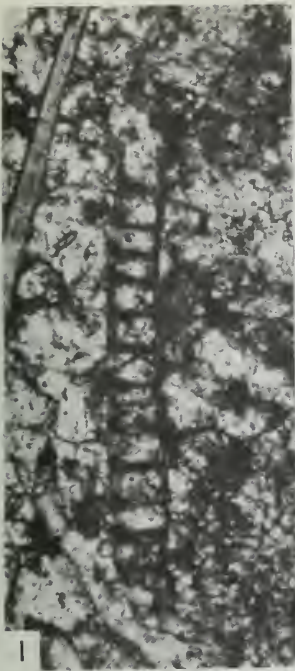
**DISCUSSION.** This little organism occurs free and often apparently incomplete amongst the foraminifera, etc. of the parent rock. None have been seen clearly attached to solid objects; one doubtful example is probably an accidental juxtaposition. Nevertheless, the morphology suggests attachment, possibly to non-calcified algae, fixed or floating, presumably in shallow water. The North Yorkshire rock sample comes from a limestone quarry which shows evidence of emergence in a thin coal-seam with underclay (Kendal & Wroot 1924 : (1) 59; Hudson & King 1933 : 434), and the areal stratigraphy (Hudson 1933 : 247) indicates shallow marine conditions compatible with the habitat suggested. The Northumberland limestone does not conflict with this: it is similarly rich in foraminifera and microporobionta.

An animal origin, e.g. some lowly-organized colonial growth such as a simple extinct hydrozoan, seems unlikely in view of the very small cells and the absence of intercommunicatory pores through the walls. If, however, the cells are regarded as originally open on the upper or outer surfaces, the occasional closed examples being ascribed to either diagenesis or original abnormality, then this could support animal origin of some kind, with a tentative reproductive function for the special cells. There is a superficial resemblance and approximate size-correspondence to the Precambrian *Papillomembrana* (Spjeldnaes 1963, 1967), but this problematicum was probably carbonaceous not calcareous, cylindrical not plate-like, and the fringing projections are papillae, not wall-sections of polygonal mesh. If, however, *Hypocastella* is considered as a small calcareous alga, size and lack of pores are in keeping, though there is still some uncertainty.

Monostromatic crusting corallines (Rhodophyta; family Corallinaceae) referable to the genus *Lithoporella* Foslie are common at the present day and in the Cenozoic (Lemoine 1974, 1976), usually attached to solid objects, organic or inorganic. The high-rectangular cells are squarish in

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**Figs 1-7** *Hypocastella cartimanduae* gen. et sp. nov. Lower Carboniferous, Great Scar Limestone (Viséan D<sub>1</sub>); Mealbank Quarry, Ingleton, North Yorkshire. Thin sections,  $\times 120$ . V-numbers are registered numbers, Dept of Palaeontology, British Museum (Natural History). Fig. 1, rectangular cells, some roofed, in vertical cut; V.21205c. Fig. 2, small-celled individual showing branching; V.21205b. Fig. 3, polygonal cells in transverse cut; V.21205d (same thin section as holotype). Fig. 4, part of large-celled individual in vertical cut; V.21205e. Fig. 5, polygonal cells, slightly oblique view of walls in the thickness of the preparation; V.21205a. Fig. 6, special cell in centre of ordinary cells; V.21205f. Fig. 7, **holotype**. Apparently complete individual showing ordinary cells (left and right), special cell (top centre); twisting plane of organism gives polygonal view of cells (top left); V.21205d.



transverse section; the conceptacles are large blister-like objects rising above the thin thallus. Calcification of the box-like cells is usually complete in the fossils.

In the Mesozoic, *Thaumatoporella* Pia (Trias-Cretaceous: syn. *Polygonella* Elliott, *Lithoporella* spp.) shows high-rectangular cells which are polygonal in cross-section: the calcification is sometimes incomplete, especially that of the upper cell-surfaces, but in numerous examples examined by me this appears to be due to the varying preservation. The conceptacles are rarely found, but are similar to those of *Lithoporella* (Emberger 1958). Like *Lithoporella*, *Thaumatoporella* seems to have been attached to solid objects.

Example	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Cell-height	30	30	36	40	40	45	45	45	54	54	63	63	72	80	80	108
Cell-width	20	30	36	20	40	30	36	45	36	40	36	36	45	40	45	54
Conceptacle-height	45			45							63	63				
Conceptacle-width	63			63							80	100				

Fig. 8 Tables of cell-dimensions ( $\mu\text{m}$ ) in different examples of *Hypocaulstella*.

*Hypocaulstella*, then, is possibly to be regarded as a Palaeozoic algal growth of similar coralline nature from its vegetative thallus, the frequent absence of calcification on the upper or outer cell surfaces being due to non-preservation of an original thin calcification, and the attachment-habit being to non-calcified algae. If the larger cells are interpreted as conceptacles, they are clearly different from the very conspicuous structures seen in *Lithoporella* and *Thaumatoporella*. Can *Hypocaulstella* be regarded as an ancestral monostromatic coralline alga?

Of other possible Palaeozoic claimants for this, the Permian *Archaeolithoporella* (Endo 1959 : 182) was accepted as such until recently. However, Babcock (1974 : 38) has shown that, although probably but not certainly algal, it is laminar but not cellular, and certainly not coralline; the significance of this is emphasized by Wray (1977). The peculiar *Litostroma oklahomense* (Pennsylvanian: Mamay 1959), whilst a monostromatic alga, possibly a rhodophyte, does not show conceptacles and does not seem to be a coralline. European records of this species, given in structural detail and reviewed by Homann (1972 : 170), who includes *L. europaea* Kochansky-Devidé (1970) as a synonym, yield no real evidence to make its taxonomic position more precise. *Stenophycus* (Devonian: Fenton 1943; Wray 1967) is a composite, doubtfully 'primitive coralline' structure which does show blister-like conceptacles but is not technically monostromatic. *Eolithoporella dawsoni* Johnson (1966), from the Canadian Mississippian, is perhaps the nearest to *Lithoporella*, but is based on very limited material and conceptacles are not known.

All of these have considerably larger thalli than *Hypocaulstella*, and although of Upper Palaeozoic age, are very clearly spreads of roofed cells or laminae, with only occasional loss in preservation. *Hypocaulstella* is curiously distinctive in this character, so its algal nature cannot be regarded as certain.

Pre-Cretaceous genera referred, often doubtfully, to the Corallinaceae are a scattered assemblage whose individual members seem to have become extinct. *Archaeolithophyllum* (not monostromatic: Johnson 1956) is the most convincing. If *Hypocaulstella* is referable to this group, and this is not certain, it must be regarded as similarly individual, and not in the main evolutionary stream, since its 'conceptacles' are not of the characteristic large blister-like pattern. It would be unwise at present to extrapolate further from this isolated little organism, whose systematic position is so doubtful.

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